

# Research on open source e-learning tools and agricultural applications

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## Abstract

Within the NODES European e-Learning project (Creation of a European network of multimedia resource centres for adult training) we have done research and developments based on open source tools. One of the aims was to select those open source components which are suitable for creating the network for using multimedia knowledge to improve competitiveness employability and mobility of different target groups, such as rural people and farmers. In creating the architecture of the NODES project there were more tasks which were coordinated and carried out by our expert group. The selection criteria of open source LMS was set up by the consortium. Our studies' Survey on the existing systems consisted of the following parts: The basic elements of e-Learning Systems, The complements and integration of the e-Learning Systems, The specification of interface. The result of our research work was that we selected the Moodle LMS. The Moodle provides a reliable platform that supports social and collaborative learning. It is highly configurable and extensible. It implements new features and fixes rapidly, it is free of licensing costs. The members of the project (from France, Spain, Ireland, Hungary, Czech Republic and Romania) implemented the Moodle system creating the LMS. To integrate the different contents we had to develop the EU-index, which is the central, common and shared index database (a metadatabase). Another important function is the multimedia content management. One of these parts is the AutoView Presenter from the about 200 modules which allows putting video on-line with synchronised slides. The NODES system is used in graduate, postgraduate PhD, adult trainings programmes and it is a very successful system as an educational portal system for our faculty too.

**Keywords:** learning management systems, open source, e-learning

## Introduction, open source software

The use of open source software (OSS) has taken off over the past decade, there has been increasing interest in the potential of open source to address longstanding concerns in the higher education community regarding the cost and performance of commercial software products view of open source e-learning development. The use of open source software (OSS) has grown rapidly in the last decade, and the growth has been accelerating over the period. OSS is widely used in many domains, most notably in the operation of computers and computer networks. Among the best-known applications are the Apache web server, which runs 65% of active websites, and Linux, which is estimated to operate on 20% of servers. There are also many open source solutions, in use for web browsers, e-mail, instant messaging, file sharing and other applications (Courant, 2006). Wheeler examines market share, reliability, performance, scalability, security, and total cost of ownership in trend. This study shows that the OSS became more and more important and the share of OSS users are growing. (Wheeler, 2007). As institutions of Higher Education are working in changing environment the try to balance limited resources with the rising costs of technology (Nábrádi,

2007). Some institutions are turning to Open Source software for campus-wide applications such as course management systems and portals. One of the many trends in Higher Education is the growing visibility of the Open Source software movement.

E-learning applications are becoming commonplace in most higher education institutions, and some have implemented open source applications such as course management systems and electronic portfolios (Varallyai and Péntek, 2008). With open source, higher education institutions can easily and freely audit their systems. E-learning applications comprise different features and functionalities that support the online learning environment.

### **Open source LMS selection**

The Campus Computing Project is the largest continuing study of the role of computing, information technology, and eLearning in American higher education. The project's national studies draw on qualitative and quantitative data to help inform faculty, campus officials, policy-makers, and others interested in a wide array of information technology in the United States. A new item on the 2008 survey asked respondents about the likelihood that their institutions will migrate to Software as a Service (SaaS) or Open Source administrative applications within five years, by 2013. About a fourth (24.4 percent) of the survey respondents report a high likelihood that their institution would migrate to an Open Source Learning Management System (LMS) by 2013. For example, Blackboard remains the dominant LMS provider in higher education: 56.8 percent of the campuses in the 2008 survey identified Blackboard as the single product campus LMS standard, down from 66.3 percent in 2007. As of fall 2008, almost a fourth (23.7 percent) of private four-year colleges identified Moodle as the campus standard LMS, compared to 17.2 percent in 2007 (Campuscomputing, 2008). In the US, the collaborative development and sharing of instructional content is not new. The TLT Group (TLT 2005) has been offering online assessment tools, web page templates and tutorials to institutions on a low-cost subscription basis since 1992. The EduTools Web site offers independent analysis and tools for evaluating course management systems, student services software and e-learning policies (EduTools 2007). As of May 2007, EduTools provides a feature-function comparison of 61 course management system versions in production worldwide. Of those 61 products, 31 are Open Source, nearly all (27 of 31) of which were developed outside of North America. MERLOT is one of the longest-running Web sites providing free materials from faculty for faculty in a variety of disciplines. However, there is not much reliable data on usage of the materials posted to the site. MIT's OpenCourseWareWeb site is a more recent example of free access to instructional materials. The materials are targeted to educators and learners worldwide, with the biggest market outside the US and the primary use being the enhancement of personal knowledge (Carson 2004). It is not yet clear to what extent these materials have been adopted by American learners, institutions and faculty. For those countries that already have broad adoption of Open Source software for teaching and learning and who may have concrete evidence about the total cost of ownership of Open Source applications (Rooij).

The Open University (OU) is Europe's largest higher education provider one of a handful of mega-universities across the world. In 2004, planning began for the development and roll-out of an integrated LMS across the university. The project framework rates open source software according to seven weighted criteria, Functionality: 25%, Usability 20%, Documentation 15%, Community 12%, Security 10% Support 10%, Adoption 8%. In 2005 the OU selected Moodle as the basis for its LMS, which enabled the Open University to develop an effective online learning platform for its 180,000 distance learners (Sclater, 2008).

The evaluation criteria of any e-learning system must start first with an understanding of the goals of the institution. This evaluation criteria would include the following: known requirements, unknown future requirements, implementability, support, cost. In addition to supporting the university's visions, mission, and goals, the evaluation of a specific e-learning tool must take into consideration the learner, the faculty, and the administration. According to an evaluation of 10 of the most popular open source system the Moodle, Sakai and ATutor (Olla, 2007).

### *Selection in the NODES project*

The aim of the NODES project was to use the multimedia knowledge, in order to facilitate competitiveness, employability and mobility of adults who are victims of the digital divide or some of its components such as distance, initial level of knowledge, language, use of complex technologies. We needed to study the 'What is existing in GNU/GPL software' in the NODES context. This paper summarizes the survey of the most important e-Learning systems (free and commercial) and their functional features, modules, standards, hardware and software requirements.

The study could be an input for the further steps. It tried to give information to select and develop a free licensed system for the several target groups. We studied a lot of e-Learning systems. One of our tasks in the Nodes project was to study the existing open source or commercial e-learning software. The aim of the investigation of these systems was to survey the most important functional features, modules, standards, hardware and software requirements.

After the comparison of the e-Learning systems by several methods, we had to evaluate the most important parameters, which were suitable suggestion for the project management. These parameters were evaluated.

### *Evaluating aspects*

- *Technical flexibility:* Hardware and software requirements, Support, Cost/License, Authentication
- *Learning tools:* Forums, Materials, Messenger, Chat, Exercises, Group work, Student tracking.
- *Usability:* Technical knowledge/installation, Course templates, Standards, Languages.

Reviewing these parameters, our suggestion was the Moodle or the ATutor. We examined these systems in details. Both of them are fully compatible with the current Shareable Content Object Reference Model (SCORM) standards for sharing content between different LMSs. Additionally, both of the systems use XML metadata to describe e-learning content within the systems. Yet, without the encumbering technical elements of the SCORM the authoring process for new courses is much simplified. Creating a new course can be as simple as designing several different 'pages' (Moodle, ATutor) of content, and then organising them so that they flow in a logical manner. In addition consultants can assign specific resources to each slide. In Moodle and ATutor there would not be a requirement for HTML knowledge when authoring content.

The collaborative features included in the learning environments vary in both complexity and usability. The ATutor is the only system having an internal 'e-mail' system which allows course users to intercommunicate. We believe that this is a very useful feature to have within a LMS, as it promotes collaboration between users. Additionally, each system requires a valid e-mail address to be collected from each user so communication via external e-mail systems would be entirely possible. On an authoring note, we found that Moodle's interface for creating course content was the most intuitive, and it is very simple to use What You See Is What You Get (WYSIWYG) editor. The use of this editor would remove the need for the consultants to learn any Internet display languages such as Hyper Text Mark-Up Language (HTML), which would significantly reduce the development time required to start creating course content.

Finally we selected the Moodle which is a software package for producing internet-based courses and web sites (Lengyel et al., 2006). It is an ongoing development project designed to support a social constructionist framework of education. Moodle is provided freely as Open Source software (under the GNU Public License). Basically this means Moodle is copyrighted, but that you have additional freedom. You are allowed to copy, use and modify Moodle provided that you agree: to provide the source to others; not to modify or remove the original license, and apply this same license to any derivative work. Moodle will run on any computer that can run PHP, and can support many types of database. The word Moodle was originally an acronym for Modular Object-Oriented Dynamic Learning Environment, which is mostly useful to programmers and education theorists. It's also a verb that describes the process of lazily meandering through something, doing things as it occurs to you to do them, an enjoyable tinkering that often leads to insight and creativity. So it applies both to the way Moodle was developed, and to the way a student or teacher might approach studying or teaching an online course.

### **The architecture of the NODES**

On Figure 1 you can see how the NODES Network (central repository) is build up the and how the participant countries and the actors (trainer, learner, content designer and manager) are connected. The main parts of the logical architecture are the following:

- Learning Management System, LMS;
- Local – National Repository, LNR;
- Knowledge Databank Management System KD CMS / KMS;
- Specific and Shared Databases, SSD;
- EU Index, EUI;
- Internet, Content Access and Security Rules, I-CASR;
- NODE point: Physical implementation and network infrastructures;
- The NODES virtual central services and infrastructure;
- Asynchronous and RT (Rural Transport) Services and Support in Adult Education;
- IP Networks and Internet;
- The services of the NODES project management.

#### *Moodle in the aspects of NODES project*

The Moodle provides a reliable platform that supports social and collaborative learning. It is highly configurable and extensible, it implements new features rapidly and it is free of licensing costs. The members of the NODES project (France, Spain, Ireland, Hungary, Czech Republic and Romania) implemented the Moodle system creating the LMS. To integrate the different contents we had to develop the EU-index, which is the central, common and shared index database (a metadatabase). The EU Index, the merging of each local - national index (based on KD - Knowledge Database - and selected links like available resources / websites / etc.). The EU-index is based on the Dublin Core Patent. The Dublin Core Metadata Element Set is a vocabulary of fifteen properties for use in resource description. Another important function is the multimedia content management. One of these parts is the video objects. From the about 200 Moodle modules and blocks we are using for example the AutoView Presenter which allows you to put video on-line with synchronised slides. The NODES system is used in graduate, postgraduate PhD, adult trainings programmes and it is a very successful system as an educational portal system for our faculty too.

In the framework of the National Rural Development Plan 2004-2006 400 consultants carried out advisory tasks for public-benefit. From the civil servants of the Ministry's Agricultural Offices in

# NODES logical Architecture

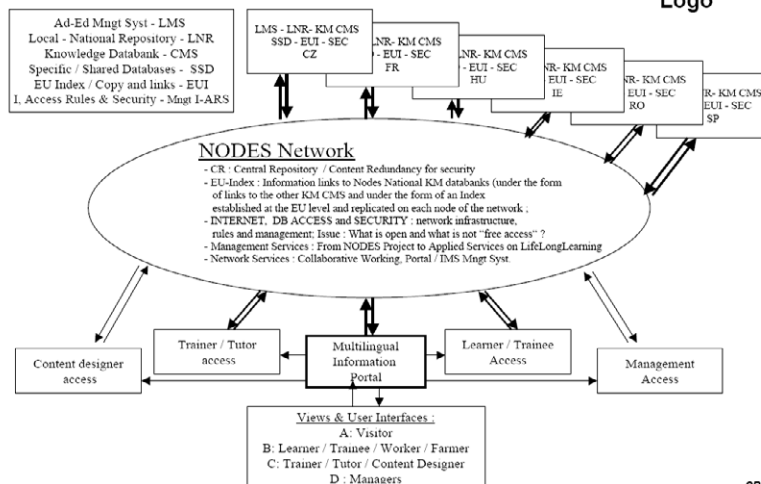


Figure 1. NODES Logical Architecture (Burriel, 2007).

the counties the village agri-economist experts (650) – related to their public administration tasks– also supply farmers with general information and advice. The aim is to increase the number of farmers making use of the special advisory services by 35.000 in the years between 2007 and 2013. Relating to this aims the Hungarian partner of NODES project organized NODES training for village agri-economist experts. The numbers of participants were 21 village agri-economist experts from Hajdú-Bihar county (neighbourhood of Debrecen). It is important, because they can be potentially tutors of the farmers. Their tasks are the training of the farmers by distance learning using the modern information and communication technology (e-Learning).

- In the first block we introduced them our department. The trainer focused on the Agricultural Computer Engineer field of study (basic and advanced subjects, as well special subjects from the 7 semester). In the second part he spoke about the Information and public administration agricultural engineer BSc education and the European Master initiative.
- In the second block we introduced them the development of Internet technology from the beginning till nowadays and the expected future. The presentation focused on the Web 2.0 technology
- The third block introduced them using of e-Learning framework system, the Moodle. The presentation focused on the Moodle system. He could show some statistical data about using this system in the last year. Now we have more than 1000 students and more than 30 courses. In the second part of this presentation they could get picture about the using of the Moodle system.

Finally, the participants filled out a questionnaire. The assessment of this questionnaire is in progress. Generally we can say, the village agri-economist experts want to learn basic Information Technology. The most important are: operation systems, word processing, spread-sheeting, Internet and Communication. Nowadays, it seems that the most important is the Internet and Communication module, because the village agri-economist experts having to fill in a CAP (Common Agricultural Policy) application form, using this knowledge.

### *Using moodle at UD*

We have been using Moodle at the University of Debrecen, Business- and Agricultural Department since January 2007. Moodle has more and more function at our Department in education. In January 2008 we introduced Moodle in our Faculty. Therefore, we gave lessons for the tutors about the usage of the Moodle. Our aim was to develop such a learning system, which is an integral part of educational process.

We used the Moodle in classworks in the framework of 5 subjects in the beginning, in the 2nd half of the 2006/2007 academic year. In the informatics category the number of the active courses increased to 17 in the 1st half of the 2007/2008 academic year.

We showed Moodle system on the courses organized for the instructors where we took an introduction of the system and where we outlined the function of the system and its applicability. The aim of the course was to make our trainings more coloured and more efficient, and the rest of the departments of the faculty use it in the educational process with our vocational support.

We use the system in BSc, MSc, PhD and Erasmus trainings. Our department took advantage of the functions of the framework system in a training and NODES Project beside this.

Currently 91 instructors of the 6 departments of the faculty - on 26 specialisations with 167 courses - use the system, through which more than 3600 students were involved in the educational process. On the Figure 2 there is a diagram about the usage of Moodle from 2008 March to 2008 December.

### *LAMS integration*

LAMS (Learning Activity Management System) is a revolutionary new tool for designing, managing and delivering online collaborative learning activities. It provides teachers with a highly intuitive visual authoring environment for creating sequences of learning activities. These activities can include a range of individual tasks, small group work and whole class activities based on both content and collaboration. LAMS can be used as a stand alone system or in combination with other learning management systems (LMS) such as Moodle.

LAMS provides teachers with a visual authoring environment for creating, storing and re-using sequences of learning activities. Teachers drag and drop activities into the authoring interface and then join the activities together to produce a learning sequence. This workflow model is what principally distinguishes LAMS from other more content based LMS by providing teachers and learners with sequences of activities with a high level of interactivity and collaboration. LAMS has a wide range of tools designed to be used for a range of pedagogical approaches, by teachers

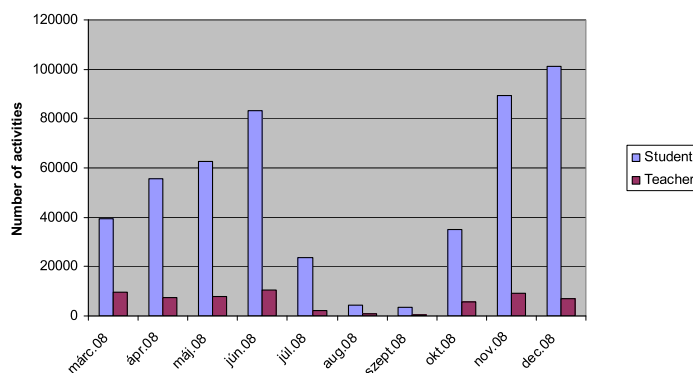


Figure 2. Statistics of a Moodle system in the number of activities.



and students with varying levels of technical expertise. LAMS is to be integrated with Moodle, with LAMS acting as either a course format or as an activity within Moodle. The integration will be done using Moodle 1.8.2 and LAMS 2.2.

We would like to use LAMS to make our education more efficient. We integrated the Moodle and the LAMS systems. We plan to create a learning design which is implemented at an informatics course.

## **Consequenses**

In January of 2009 Moodle has a large and diverse user community with over 612,000 registered users on this Moodle site alone, speaking over 78 languages in 203 countries. The MoodleMoot conference has been organised annually in Hungary since 2006. In Hungary there are more than 180 Moodle sites are registered. A few belong to agricultural education institution and there are 3 official registered systems at the University of Debrecen.

For those who already have adopted of Open Source software for teaching and learning and who may have concrete evidence about the total cost of ownership of Open Source applications. Considering the e-learning environment in which the necessary function should be implemented, we found that the open source approach offers great guarantee of flexibility and easy maintenance.

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